structure of grape sugar and to make it synthetically; he succeeded in this, but, in addition, he has made 20 other sugars that had never been known before.

As work went on in organic chemistry and the methods of working with these substances were improved, and the means of distinguishing between them became more refined, it was found that there were even finer kinds of isomerism than had at first been observed. It is possible to have two or more substances of identical composition and of exactly the same chemical behavior, but differing from one another in only a very slight way. For example one compound will rotate the plane of polarized light a certain number of degrees to the right while the other will rotate the plane the same number of degrees, but to the left. In short there are right and left handed compounds. This physical isomerism, as it is called, can only be explained by assuming a different arrangement of the atoms in space. Since 1888 a great deal of work has been done in the development of the theories of space chemistry or stereochemistry. We are in a position now not only to determine how the atoms are linked to one another but also how they are actually grouped in space. Stereochemistry is the most attractive field of research in organic chemistry to-day. Prominent among the men who have contributed to this department of chemistry are Van't Hoff, Wislicenus, Baeyer and Emil Fischer.

PROGRESS IN PHYSICAL CHEMISTRY.

During the past fifteen years the borderland between chemistry and physics has been very successfully cultivated, and a new department of chemistry has resulted. This is the department known as physical chemistry, and it deals with such subjects as thermo- and electrochemistry, with chemical statics and chemical dynamics and with the laws of solution and electrolytic dissociation. A great deal of progress has been made in all these directions. It is especially the new theories of solution and of electrolytic dissociation that have most profoundly changed our ways of looking at chemical action. We now regard a substance in solution as in a condition analogous to the gaseous state. Like a gas, the dissolved substance exerts pressure, and this pressure, which is known as osmotic pressure, obeys the same laws that gas pressure does. One great practical benefit that has resulted from the laws of solution is that it is no longer necessary to convert a substance into a gas in order to find its molecular weight; it is only necessary to dissolve it in some solvent, and from the changes which it produces in the freezing point or boiling point or vapor tension of the solvent to calculate the molecular weight.

The theory of electrolytic dissociation has greatly modified our ways of interpreting the ordinary reactions of analytical chemistry. We now hold that in all dilute solutions of acids, bases and salts, in short the compounds of inorganic chemistry, we have no longer the unchanged substances, but their positive and negative ions. In the act of dissolving in water the acids, bases and salts are more or less completely split into their ions, and the chemical changes that take place in these solutions are reactions between these ions. A great many facts of analytical chemistry, of electrolysis and such empirical laws as the law of thermoneutrality of salt solutions and of the constant heat of neutralization of acids and bases, heretofore inexplicable, have now received a rational and natural explanation by means of this theory of electrolytic dissociation.

EDWARD H. KEISER.

CAMPANUS.

MANY of the early editions of the 'Elements' of Euclid, among them the *editio prin-*

ceps of 1482, carried a commentary said to be by 'Campanus of Novara.'* That means that everything except the enunciations was by Campanus; for the early notion was that all the demonstrations were the work of editors. Of course that was entirely erroneous and, as far as the first book is concerned, a most monstrous error, since that book is one of the most deeply studied statements that ever was drawn up in any branch of thought.

The Latin text of Euclid which accompanied this commentary had been derived indirectly from an excellent Greek text, decidedly superior to the common traditional text of later times; though in certain details it was faulty. But there are many indications that the translation was not made directly from the Greek, but from the Arabic. There is said to be a 'controversy' as to whether the translation was due to Campanus or not. But as far as I can discover, the 'controversy' consists in this, that everybody who has made any independent inquiry into the matter, such as Tiraboschi and Charles Jourdain, says that the version is that of Adelard of Bath; while the German writers, none of whom have really examined the evidences, either roundly assert that it is by Campanus or decline to enter into what they call the 'controversy.'

The commentary of Campanus is very unequal. In some places, especially in the tenth book, it rises to a high level of mathematical reasoning; while in some other places it is beneath criticism. For the most part, it is very respectable.

Campanus himself has remained an obscure personage. He has usually gone by the name of Campanus, *tout court;* but now and then he has been called Johannes Campanus. It appears that Joannes de Lyneriis, who, about 1310, wrote an 'Abbrieviatio Instrumenti Campani,' so calls him; and there is other XIVth-century evidence to prove that that was his name (see Boncompagni, XVII., 783, 784). In regard to his age, a MS. work of Petrus Peregrinus, to which internal evidence assigns the date 1261, refers to the planetary tables of Campanus (Boncompagni, I., 5), while Roger Bacon is said to speak of him as still living. These facts agree with the assertion of Baldi (whose life of Campano, dated 1588, is given in Boncompagni, XIX., 591), and fully proved by Tiraboschi (Storia della Letturatura Italiana, Tomo IV., Libro II., capo ii., § 8), that he was chaplain of Pope Urban IV., who reigned from 1261 to 1264.

I think that I can fix the date of the commentary upon the 'Elements' within a year or so. In the collection of elementary mathematical works which have been brought together by George A. Plimpton, Esq., there is a manuscript of this commentary upon vellum, written in a very handsome, but stiff and slightly elongated, book-hand, which might have been written at any part of the last half of the XIIIth century, though I think it would be surprising to find that it was as early as 1250. Just below the colophon of this MS., where the owner of such a book frequently wrote his name, one can read in a careful cursive hand of, say, the third quarter of the XIIIth century, or thereabout, a pious sentence in the first person by 'Jacobus Dei gratia Patriarcha Jerusalemitorum.' Observe that one hardly uses the phrase 'Dei gratia' except in speaking of oneself.

It can, therefore, be asserted with considerable confidence that, soon after this MS. was written, it came into the possession of a person so describable. But that could only be Jacques Pantaleone, who, having

*The colophon of the first edition reads: Opus elementorum euclidis megarensis in geometriam artem. In id quoque campani perspicassimi commentationes finiunt. Erhardus ratdolt Augustensis impressor solertissimus venetijs impressit. Anno salutis MCCCCLXXXII Octavis Calendis Junii. Lector Vale. Euclid was always confounded with Euclides of Megara.

been only a short time before elevated to the dignity of Patriarch of Jerusalem, became on the 29th of August, 1261, Pope Urban IV., the known friend of Campanus. He would naturally receive one of the first copies. Indeed, there is evidence that it was hastily given to him; for the geometrical figures are not drawn all the way through the MS., notwithstanding its being an exceptionally handsome MS., for such a work. It seems, then, that the book must have been published, say, within a year of August, 1260.

If this inference be admitted, we have in the commentary of Campanus, considering its respectable strength, occasionally its remarkable strength, additional evidence of the promising beginning of science which was made in the thirteenth century until all that sort of thing was swept away before the flood of scholasticism; while in its lapses into utter absurdity, though they are but rare, we meet with another characteristic which is marked in Petrus Peregrinus, in Roger Bacon, and in other scientific students of that period.

C. S. PEIRCE.

P. S. I notice that Moritz Cantor (II., 100) will have it that Urban reigned until 1281. Considering what a difference it would have made for the history of Sicily, for our friend Roger Bacon, and for some famous works of literature, if he had, the slip is, perhaps, worth notice.

When I can have the privilege of examining the MS. again and of consulting a library, I think I can strengthen my proof of the date of the work.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE following is the list of those who have been elected members of the American Association for the Advancement of Science and have completed their membership from January 1 to April 30, 1901. The list includes the names of twenty-six former members and fellows, who have since January 1st been restored to the list by payment of arrearages for more than two years.

Adams, C. C., University of Chicago, Chicago, Ill.
Adams, Frederick C., Teacher of Science, Classical High School, Providence, R. I.
Alderson, Victor C., Dean of the Technical College, Armour Institute of Technology, Chicago, Ill.
Alexander, Chas. Anderson, M.E., 10 Vine St., Batavia, N. Y.
Alleman, Gellart, Ph.D., Instructor in Chemistry, Washington University, St. Louis, Mo.
Alpers, Wm. C., 45 West 31st St., New York City.
Ames, Oakes, Assistant Director of the Botanic Garden of Harvard University, North Easton, Mass.
Appleton, John Howard, Professor of Chemistry, Brown University, Providence, R. I.
Ashmead, Wm. H., Department of Insects, U. S. National Museum, Washington, D. C.

Baekeland, Leo, M.D., 'Snug Rock,' North Broadway, Yonkers, N. Y.
Baerecke, John F., Ph.D., M.D., Professor of Biology, Stetson University, DeLand, Fla.
Bagby, J. H. C., Dept. Physical Science, Hampden-Sidney College, Hampden-Sidney, Va.
Baker, James H., President of the University of Colorado, Boulder, Colo.
Ball, Elmer Darwin, Assistant Professor of Zoology, Agricultural College, Fort Collins, Colo.
Ball, Miss Helen Augusta, 43 Laurel St., Worcester, Mass.
Bancroft, Frank Watts, Ph.D., Instructor in Physiology, University of California, Berkeley, Cal.
Bancroft, Wilder Dwight, Instructor in Chemistry, Cornell University, Ithaca, N. Y.
Bardeen, Charles Russell, Anatomical Laboratory, Wolfe and Monument Sts., Baltimore, Md.
Barr, Charles Elisha, Professor of Biology, Albion College, Albion, Mich.
Bauder, Arthur Russell, Instructor in Physics, Boardman High School, New Haven, Conn.
Beach, Miss Alice M., 932 W. Illinois St., Urbana, Ill.
Beach, Charles Coffing, M.D, 54 Woodland St., Hartford, Conn.
Beede, Joshua William, Atchison County High School, Effingham, Kans.
Beers, M. H., 410 Broadway, New York City.
Bentley, Wray Annin, Instructor in Metallurgy, Columbia University, New York City.
Bergström, John Andrew, Ph.D., Associate Professor of Psychology and Pedagogy, Indiana University, Bloomington, Ind.